

REMARKS

Re-examination and favorable reconsideration in light of the above amendments and the following comments are respectfully requested.

Claims 1 - 24 are pending in the application. Currently, claims 1 - 15 and 17 - 24 stand rejected and claim 16 stands objected to. Previously, claims 25 - 44, drawn to a non-elected invention, have been cancelled.

By the present amendment, objected to claim 16 has been placed into independent form and is thus allowable.

In the office action mailed February 25, 2003, claims 1, 2, 4 - 14, and 17 - 24 were rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,388,959 to Forrester et al. in view of U.S. Patent No. 6,475,253 to Culler et al.; and claim 3 and 15 were rejected under 35 U.S.C. 103(a) as being unpatentable over Forrester et al. in view of Culler et al. and further in view of U.S. Patent No. 3,834,001 to Carroll et al.

The foregoing rejections are respectfully traversed by the present response.

The present invention relates to an air seal for use in a gas turbine engine having improved durability. The air seal comprises a seal substrate and an abradable seal

layer on the seal substrate, which abradable seal layer is composed of a densified polyimide foam.

With regard to the rejection of claims 1, 2, 4 - 14, and 17 - 24 over Forrester et al. in view of Culler et al., there is no question that Forrester does not teach or suggest an abradable seal layer composed of a densified polyimide foam. Thus, in order to have a valid obviousness rejection, the secondary reference to Culler et al. must contain either a suggestion or some motivation to form an abradable seal layer to be used in a gas turbine engine from a densified polyimide foam. A review of Culler et al. shows that it contains no such suggestion or motivation. Culler et al. is directed to the manufacture of a completely different product which has no utility in gas turbine engines - namely, a coated, bonded or non-woven abrasive article containing precisely shaped particles and a binder. With regard to the portion of Culler et al. beginning at column 19, line 60 et seq., Culler et al. are talking about various backings suitable for preparing coated abrasive articles. The backings include polymeric film, primed polymeric film, cloth, paper, vulcanized fibres, polymeric foam, nonwovens, treated versions thereof, and combinations thereof. Examples of polymeric films include polyester film, polyolefin films, polyamide

films, polyimide films, and the like. There is absolutely nothing in this portion of Culler et al. which would lead one of ordinary skill in the art to form an abradable seal layer from a densified polyimide foam. In fact, Culler et al. is directed to a completely different problem - namely the formation of an abrasive article, such as a grinding wheel, having grit particles. If the Examiner maintains this rejection, he is respectfully requested to clearly state what would lead one of ordinary skill in the art to select densified polyimide foams from the laundry list of materials set forth in the cited portion of Culler et al.

With respect to claims 4 - 6 and 19 - 21, these claims are allowable because Culler et al. does not teach or suggest how to make a polyimide foam having the claimed densities. Claims 7 and 22 are allowable because Culler et al. does not teach or suggest how to make a polyimide foam having the claimed shear strength. Claims 8 - 10 and 17 are allowable because the cited and applied references do not teach or suggest the claimed combination of elements, particularly the knife edge seal of claim 10.

Claims 11 and 18 are allowable because Culler et al. does not teach or suggest the use of a thermomechanically densified polyimide foam as an abradable seal layer.

Claim 12 is allowable for the same reasons as claim 1 and further because Forrester et al. does not teach or suggest an abradable seal material applied to a bond layer. The abradable seal material in Forrester et al. is bonded directly to the substrate (see the Abstract). Element 22 in Forrester et al. is an abrasive seal structure.

Claim 13 is allowable because neither of the references teaches applying the seal between a stator box and a disk.

Claim 14 is allowable for the same reasons as claim 12.

Claims 23 and 24 are allowable because neither of the cited references teaches or suggests forming a bond layer from at least one adhesive material layer or at least one adhesive strip.

With regard to the rejection of claims 3 and 15, the Carroll reference does not overcome the deficiencies of the Forrester et al. and Culler et al. references. Thus, these claims are allowable for the same reasons as their parent claims as well as because none of the cited and applied references, alone or in combination, teaches or suggests the claimed combination of elements.

For the foregoing reasons, the instant application is believed to be in condition for allowance. Such allowance is respectfully solicited.

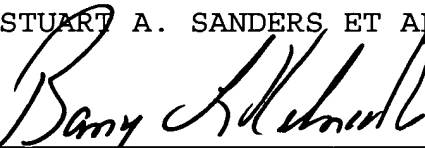
Should the Examiner believe an additional amendment is needed to place the case in condition for allowance, he is invited to contact Applicant's attorney at the telephone number listed below.

No fee is believed to be due as a result of this response. Should the Director determine that a fee is due, he is hereby authorized to charge said fee to Deposit Account No. 21 - 0279.

Respectfully submitted,

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I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: "Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313" on May 27, 2003


Nicole Motzer

MARKED-UP VERSION OF CLAIM 16

16. (Amended) A gas turbine engine seal system [according to claim 15, wherein] comprising:

a seal assembly having a seal substrate and an
abradable seal material applied to a bond layer;

said abradable seal material being composed of a
densified polyimide foam;

an engine component adapted for motion relative to the
seal assembly and having an abrasive portion interacting
with the abradable seal material, whereby the abrasive
portion of the engine component and the abradable seal
material of the seal assembly cooperates to provide
sealing;

said engine component forming part of an engine having
a centerline;

said abradable seal material comprising a plurality of
laminated layers of said polyimide foam having a lamination
plane;

said lamination plane being substantially
perpendicular to said centerline; and

said lamination plane [is] being substantially
parallel to a radial direction of said engine and
substantially perpendicular to an axial direction of said
engine.